



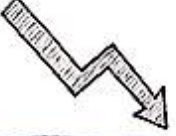
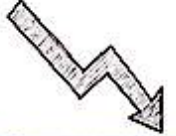
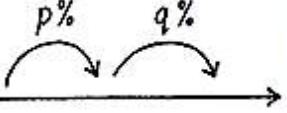
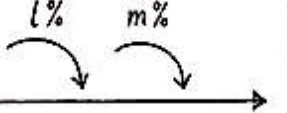
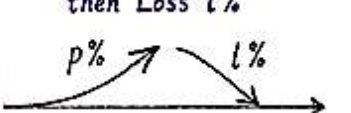
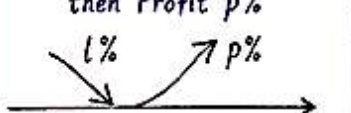


# 20 Profit and Loss Shortcuts

Quick Formulas to Solve Problems Faster

<p>① </p> <p>Loss = CP - SP</p>	<p>② </p> <p>Profit = SP - CP</p>	<p>③ </p> <p>Profit % = <math>\frac{\text{Profit}}{\text{CP}} \times 100</math></p>	<p>④ </p> <p>Profit % = <math>\frac{\text{SP} - \text{CP}}{\text{CP}} \times 100</math></p>
<p>⑤ </p> <p>Loss % = <math>\frac{\text{Loss}}{\text{CP}} \times 100</math></p>	<p>⑥ </p> <p>Loss % = <math>\frac{\text{CP} - \text{SP}}{\text{CP}} \times 100</math></p>	<p>⑦</p> <p>SP = CP × (1 + p%)</p> <p>(p% = profit percent)</p>	<p>⑧</p> <p>SP = CP × (1 - l%)</p> <p>(l% = loss percent)</p>
<p>⑨</p> <p>CP = <math>\frac{\text{SP}}{(1 + p\%)}</math></p> <p>(p% = profit percent)</p>	<p>⑩</p> <p>CP = <math>\frac{\text{SP}}{(1 - l\%)}</math></p> <p>(l% = loss percent)</p>	<p>⑪</p> <p>Profit = CP × <math>\frac{p\%}{100}</math></p> <p>(p% = profit percent)</p>	<p>⑫</p> <p>Loss = CP × <math>\frac{l\%}{100}</math></p> <p>(l% = loss percent)</p>
<p>⑬</p> <p>SP = CP + Profit</p> <p>(Profit in ₹/units)</p>	<p>⑭</p> <p>SP = CP - Loss</p> <p>(Loss in ₹/units)</p>	<p>⑮</p> <p>CP = SP - Profit</p> <p>(Profit in ₹/units)</p>	<p>⑯</p> <p>CP = SP + Loss</p> <p>(Loss in ₹/units)</p>
<p>⑰ Successive Profit</p> <p>p%      q%</p>  <p>Net % = <math>p + q + \frac{p \times q}{100}</math></p>	<p>⑱ Successive Loss</p> <p>l%      m%</p>  <p>Net % = <math>l + m - \frac{l \times m}{100}</math></p>	<p>⑲ Sale after Profit p% then Loss l%</p> <p>p%      l%</p>  <p>Net % = <math>p - l - \frac{p \times l}{100}</math></p>	<p>⑳ Sale after Loss l% then Profit p%</p> <p>l%      p%</p>  <p>Net % = <math>p - l + \frac{p \times l}{100}</math></p>



**Tips:** Memorize patterns, not just formulas.  
Practice regularly and apply them to simplify problems with confidence!



# 20 Percentage Shortcuts

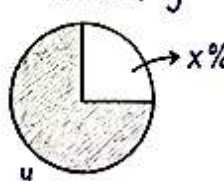
Fast Percentage Rules & Conversion Tips

①  $x\% = \frac{x}{100}$

$\frac{\%}{100}$

$x\% = \frac{x}{100}$

②  $x\%$  of  $y$

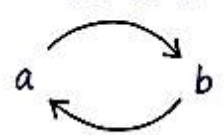


$x\%$

$y$

$x\%$  of  $y = \frac{x}{100} \cdot y$

③  $a\%$  of  $b = b\%$  of  $a$

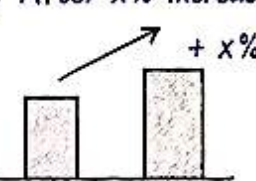


$a$

$b$

$a\%$  of  $b = b\%$  of  $a$

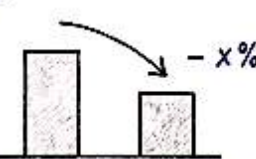
④ After  $x\%$  increase



$+x\%$

New = Original  $(1 + \frac{x}{100})$

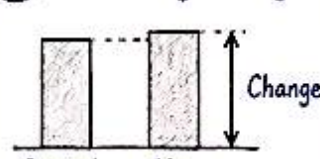
⑤ After  $x\%$  decrease



$-x\%$

New = Original  $(1 - \frac{x}{100})$

⑥ Percentage change



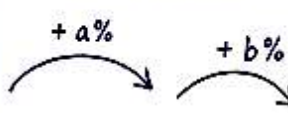
Original

New

Change

% Change =  $\frac{\text{Change}}{\text{Original}} \times 100$

⑦ Successive changes  $a\%$  and  $b\%$

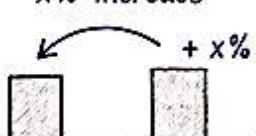


$+a\%$

$+b\%$

Net % =  $a + b + \frac{ab}{100}$

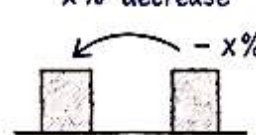
⑧ Reverse % after  $x\%$  increase



$+x\%$

Original =  $\frac{\text{Final}}{100 + x}$

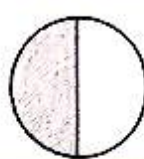
⑨ Reverse % after  $x\%$  decrease



$-x\%$


Original =  $\frac{\text{Final}}{100 - x}$

⑩ One half




$\frac{1}{2} = 50\%$

⑪ One third




$\frac{1}{3} = 33.33\%$

⑫ One fourth




$\frac{1}{4} = 25\%$

⑬ One fifth




$\frac{1}{5} = 20\%$

⑭ One eighth



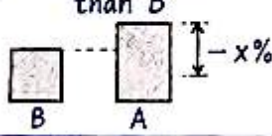
$\frac{1}{8} = 12.5\%$

⑮ One tenth



$\frac{1}{10} = 10\%$

⑯ A is  $x\%$  more than B



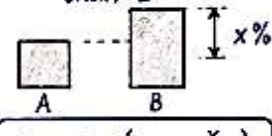
B

A

$-x\%$

$A = B (1 + \frac{x}{100})$

⑰ A is  $x\%$  less than B



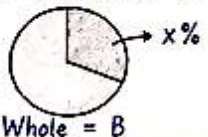
A

B

$x\%$

$A = B (1 - \frac{x}{100})$

⑱ A is  $x\%$  of B

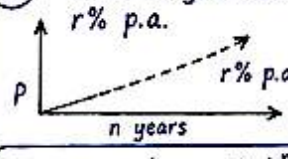


$x\%$

Whole = B

B is  $(\frac{100}{x})\%$  of A

⑲ After  $n$  years at  $r\%$  p.a.



$P$

$r\%$  p.a.

$n$  years

Value =  $P (1 + \frac{r}{100})^n$

⑳ Percentage

$\%$

Percentage =  $\frac{\text{Obtained}}{\text{Total}} \times 100$

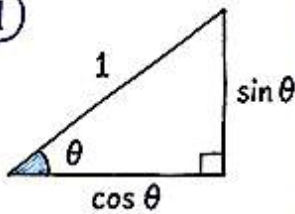
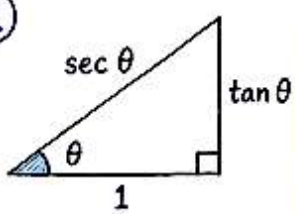
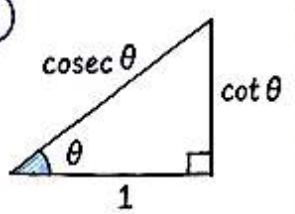
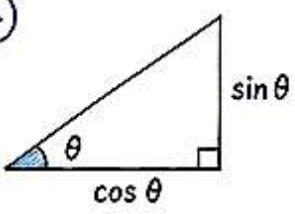
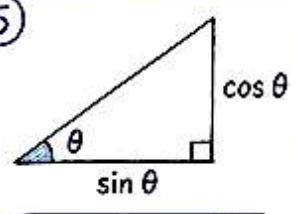
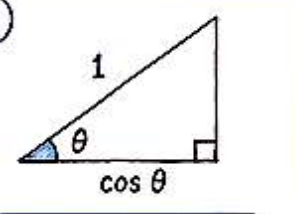
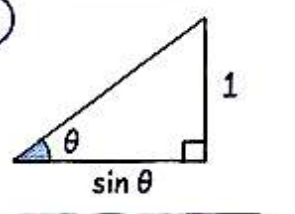
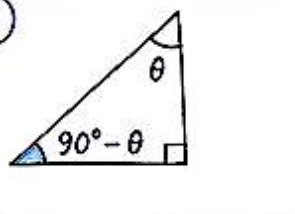
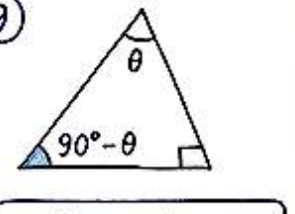
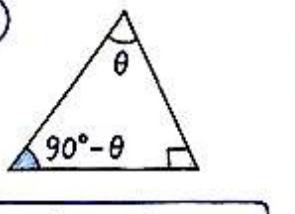
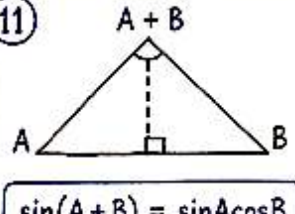
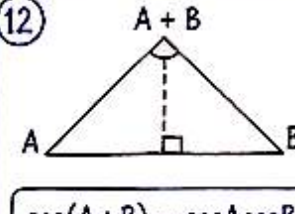
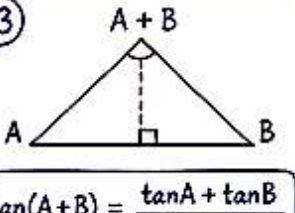
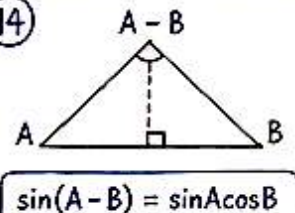
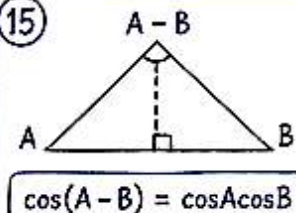
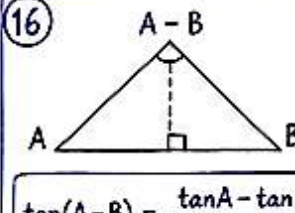
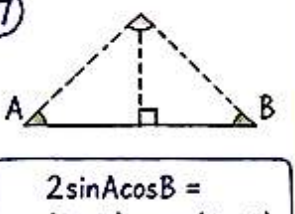
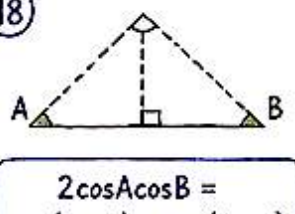
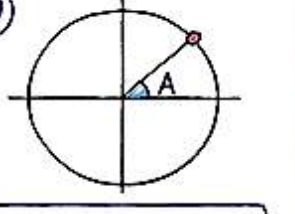
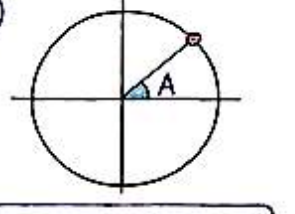


Tips: Convert to same base, cancel common factors, use easy fractions, and estimate first!



# 20 Algebra Formulas

## Fundamental, Compound & Double-Angle Rules

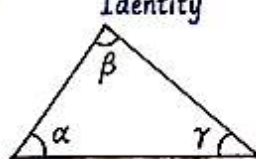
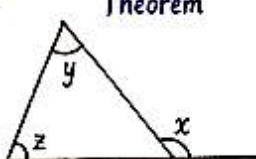
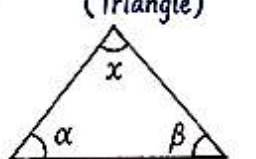
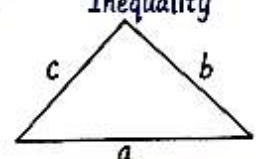
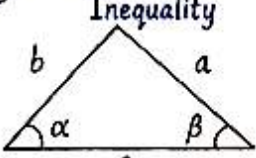
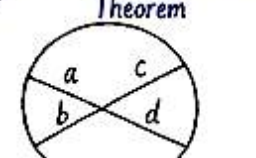
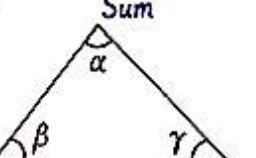
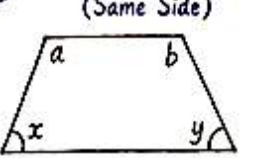
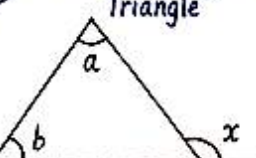
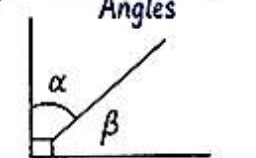
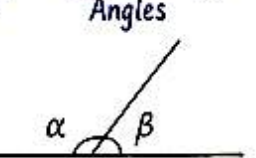
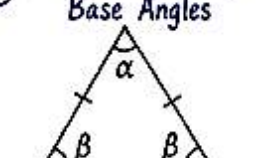
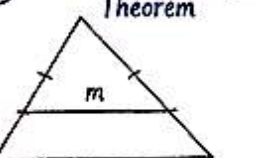
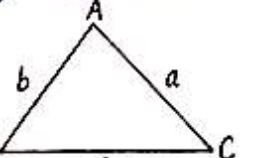
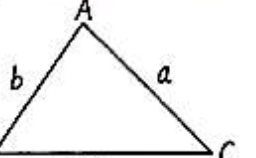
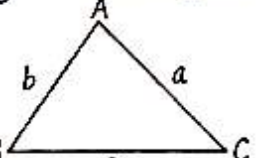
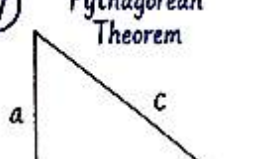
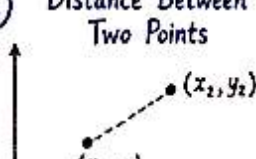
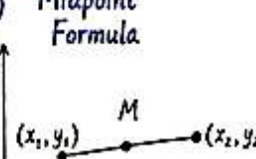
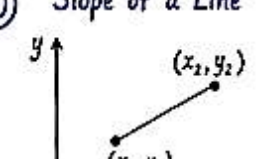
<p>①</p>  <p><math>\sin^2\theta + \cos^2\theta = 1</math></p>	<p>②</p>  <p><math>1 + \tan^2\theta = \sec^2\theta</math></p>	<p>③</p>  <p><math>1 + \cot^2\theta = \text{cosec}^2\theta</math></p>	<p>④</p>  <p><math>\tan\theta = \frac{\sin\theta}{\cos\theta}</math></p>
<p>⑤</p>  <p><math>\cot\theta = \frac{\cos\theta}{\sin\theta}</math></p>	<p>⑥</p>  <p><math>\sec\theta = \frac{1}{\cos\theta}</math></p>	<p>⑦</p>  <p><math>\text{cosec}\theta = \frac{1}{\sin\theta}</math></p>	<p>⑧</p>  <p><math>\sin(90^\circ - \theta) = \cos\theta</math></p>
<p>⑨</p>  <p><math>\cos(90^\circ - \theta) = \sin\theta</math></p>	<p>⑩</p>  <p><math>\tan(90^\circ - \theta) = \cot\theta</math></p>	<p>⑪</p>  <p><math>\sin(A+B) = \sin A \cos B + \cos A \sin B</math></p>	<p>⑫</p>  <p><math>\cos(A+B) = \cos A \cos B - \sin A \sin B</math></p>
<p>⑬</p>  <p><math>\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}</math></p>	<p>⑭</p>  <p><math>\sin(A-B) = \sin A \cos B - \cos A \sin B</math></p>	<p>⑮</p>  <p><math>\cos(A-B) = \cos A \cos B + \sin A \sin B</math></p>	<p>⑯</p>  <p><math>\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}</math></p>
<p>⑰</p>  <p><math>2\sin A \cos B = \sin(A+B) + \sin(A-B)</math></p>	<p>⑱</p>  <p><math>2\cos A \cos B = \cos(A+B) + \cos(A-B)</math></p>	<p>⑲</p>  <p><math>\sin 2A = 2\sin A \cos A</math></p>	<p>⑳</p>  <p><math>\cos 2A = \cos^2 A - \sin^2 A</math></p>



**Tips:** Memorize the fundamental identities first. Use complementary ( $90^\circ - \theta$ ), compound, and double-angle formulas to simplify problems.



# ≡ 20 Trigonometry Identities ≡

<p>① Sum of Angles Identity</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\alpha + \beta + \gamma = 180^\circ</math></p>	<p>② Exterior Angle Theorem</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>x + y = z</math></p>	<p>③ Angle Addition (Triangle)</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>x = \alpha + \beta</math></p>	<p>④ Triangle Side Inequality</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>b - c &lt; a &lt; b + c</math></p>
<p>⑤ Side-Angle Inequality</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>a &gt; b \Leftrightarrow \alpha &gt; \beta</math></p>	<p>⑥ Intersecting Chords Theorem</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>a \cdot b = c \cdot d</math></p>	<p>⑦ Triangle Angle Sum</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\alpha + \beta + \gamma = 180^\circ</math></p>	<p>⑧ Trapezoid Angles (Same Side)</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>a + b = x + y</math></p>
<p>⑨ Exterior Angle of Triangle</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>x = a + b</math></p>	<p>⑩ Complementary Angles</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\alpha + \beta = 90^\circ</math></p>	<p>⑪ Supplementary Angles</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\alpha + \beta = 180^\circ</math></p>	<p>⑫ Isosceles Triangle Base Angles</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\beta = \beta</math></p>
<p>⑬ Triangle Midsegment Theorem</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>m = \frac{b}{2}</math></p>	<p>⑭ Law of Sines</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}</math></p>	<p>⑮ Law of Cosines</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>c^2 = a^2 + b^2 - 2ab \cos C</math></p>	<p>⑯ Law of Tangents</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>\frac{a-b}{a+b} = \frac{\tan(A-B)}{\tan(A+B)}</math></p>
<p>⑰ Pythagorean Theorem</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>a^2 + b^2 = c^2</math></p>	<p>⑱ Distance Between Two Points</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}</math></p>	<p>⑲ Midpoint Formula</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)</math></p>	<p>⑳ Slope of a Line</p>  <p style="text-align: center; border: 1px solid black; padding: 2px;"><math>m = \frac{y_2 - y_1}{x_2 - x_1}</math></p>

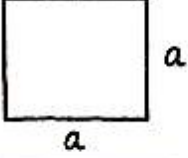
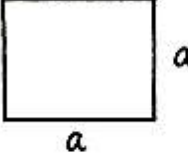
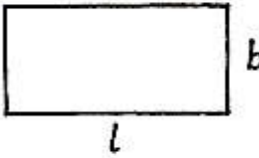
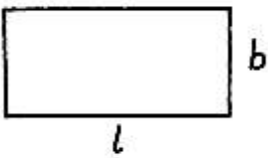
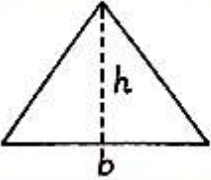
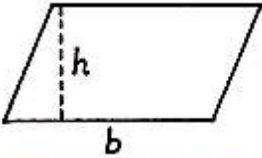
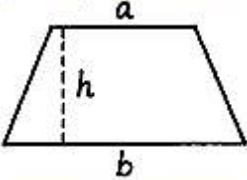
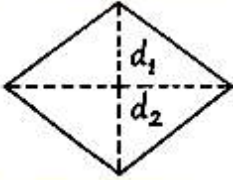
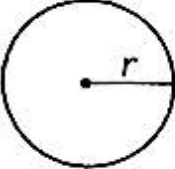
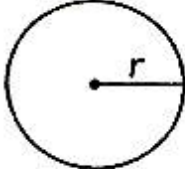
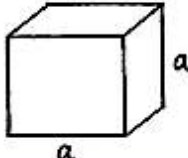
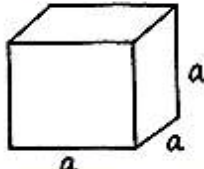
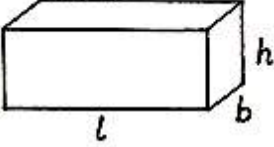
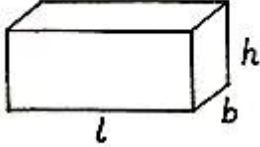
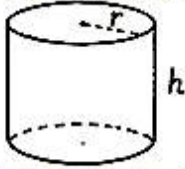
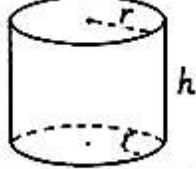
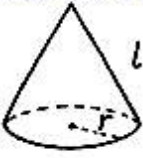
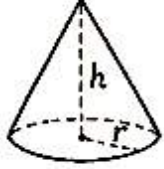
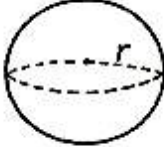
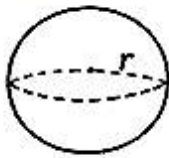


**TIPS:** Practice these identities with diagrams.  
Check units, signs, and special cases carefully!



# 20 Mensuration Formulas

## 2D Areas, Perimeters & 3D Volumes

<p>① Square Area</p>  <p><math>A = a^2</math></p>	<p>② Square Perimeter</p>  <p><math>P = 4a</math></p>	<p>③ Rectangle Area</p>  <p><math>A = l \times b</math></p>	<p>④ Rectangle Perimeter</p>  <p><math>P = 2(l + b)</math></p>
<p>⑤ Triangle Area</p>  <p><math>A = \frac{1}{2}bh</math></p>	<p>⑥ Parallelogram Area</p>  <p><math>A = b \times h</math></p>	<p>⑦ Trapezium Area</p>  <p><math>A = \frac{1}{2}(a + b)h</math></p>	<p>⑧ Rhombus Area</p>  <p><math>A = \frac{1}{2}d_1d_2</math></p>
<p>⑨ Circle Area</p>  <p><math>A = \pi r^2</math></p>	<p>⑩ Circumference</p>  <p><math>C = 2\pi r</math></p>	<p>⑪ Cube Total Surface Area</p>  <p><math>TSA = 6a^2</math></p>	<p>⑫ Cube Volume</p>  <p><math>V = a^3</math></p>
<p>⑬ Cuboid Total Surface Area</p>  <p><math>TSA = 2(lb + bh + hl)</math></p>	<p>⑭ Cuboid Volume</p>  <p><math>V = lbh</math></p>	<p>⑮ Cylinder Curved Surface Area</p>  <p><math>CSA = 2\pi rh</math></p>	<p>⑯ Cylinder Volume</p>  <p><math>V = \pi r^2 h</math></p>
<p>⑰ Cone Curved Surface Area</p>  <p><math>CSA = \pi rl</math></p>	<p>⑱ Cone Volume</p>  <p><math>V = \frac{1}{3}\pi r^2 h</math></p>	<p>⑲ Sphere Surface Area</p>  <p><math>SA = 4\pi r^2</math></p>	<p>⑳ Sphere Volume</p>  <p><math>V = \frac{4}{3}\pi r^3</math></p>

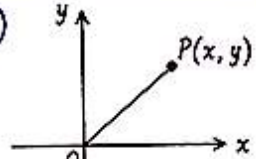
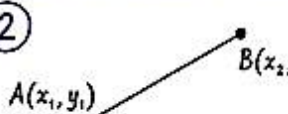

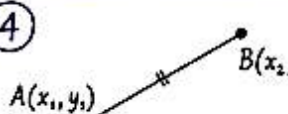
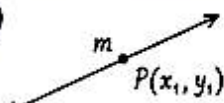
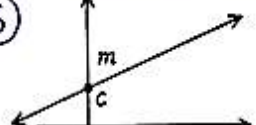
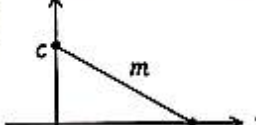
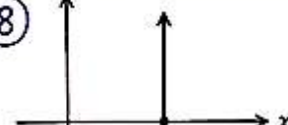
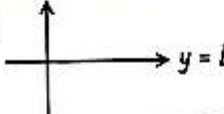
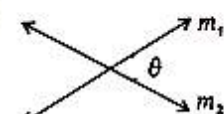
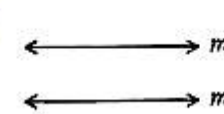

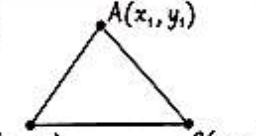
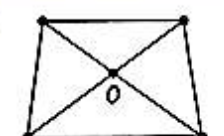
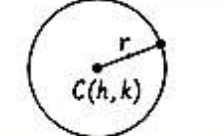
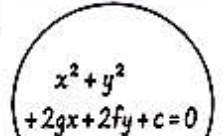
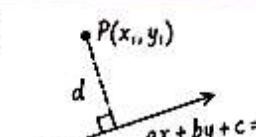
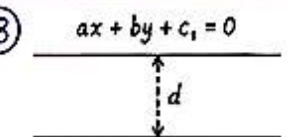
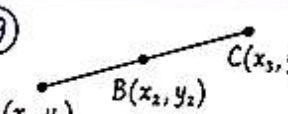
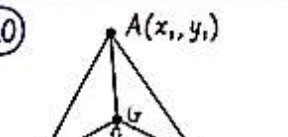


**Tips:** Keep formulas in terms of symbols.  
Use consistent units and check calculations carefully.



# 20 Coordinate Geometry Formulas

Points, Lines, Triangles, Circles & Distance

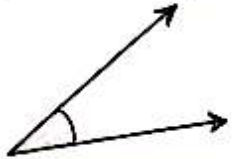
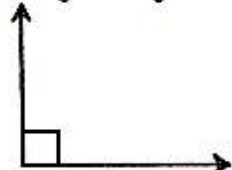
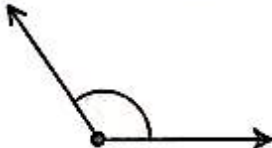

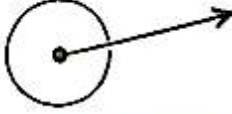
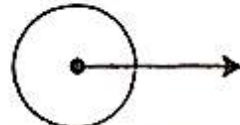
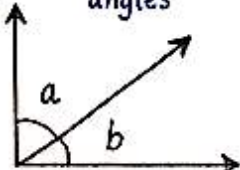
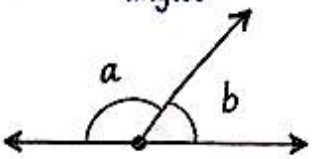
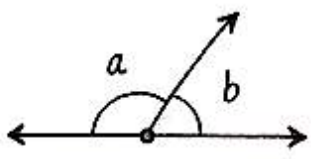
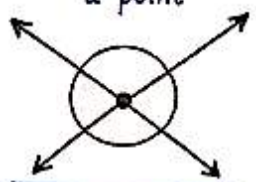
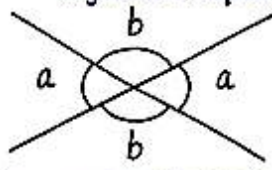
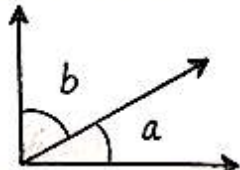
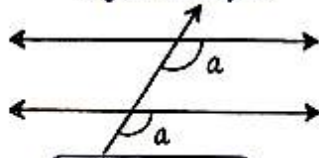
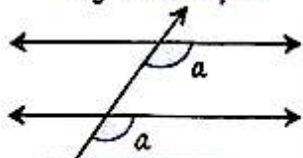
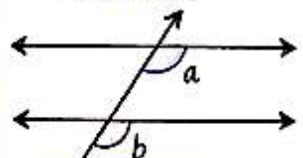
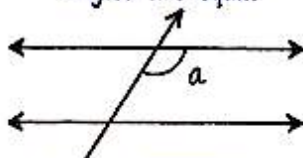
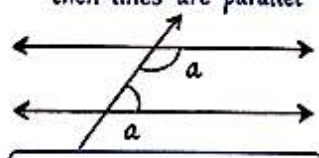
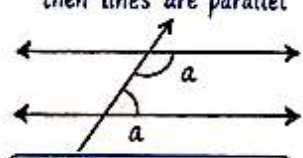
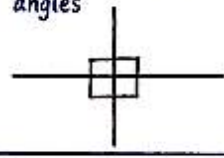
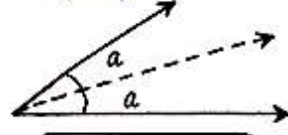
<p>①</p>  <p>Distance Formula</p> $OP = \sqrt{x^2 + y^2}$	<p>②</p>  <p>Section Formula (Internal)</p> $P\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$	<p>③</p>  <p>Section Formula (External)</p> $P\left(\frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}\right)$	<p>④</p>  <p>Midpoint Formula</p> $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
<p>⑤</p>  <p>Slope of a Line</p> $m = \frac{y_2 - y_1}{x_2 - x_1} \quad (x_2 \neq x_1)$	<p>⑥</p>  <p>Slope-Intercept Form</p> $y = mx + c$	<p>⑦</p>  <p>Intercept Form</p> $\frac{x}{a} + \frac{y}{b} = 1$	<p>⑧</p>  <p>Equation of Vertical Line</p> $x = a$
<p>⑨</p>  <p>Equation of Horizontal Line</p> $y = b$	<p>⑩</p>  <p>Angle Between Two Lines</p> $\tan \theta = \left  \frac{m_2 - m_1}{1 + m_1 m_2} \right $	<p>⑪</p>  <p>Condition for Parallel Lines</p> $m_1 = m_2$	<p>⑫</p>  <p>Condition for Perpendicular Lines</p> $m_1 m_2 = -1$
<p>⑬</p>  <p>Area of Triangle</p> $\Delta = \frac{1}{2}  x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) $	<p>⑭</p>  <p>Diagonals of a Parallelogram Bisect</p> <p>If ABCD is a parallelogram then AC and BD bisect each other.</p>	<p>⑮</p>  <p>Equation of Circle (Center (h, k), Radius r)</p> $(x - h)^2 + (y - k)^2 = r^2$	<p>⑯</p>  <p>General Equation of Circle</p> $x^2 + y^2 + 2gx + 2fy + c = 0$
<p>⑰</p>  <p>Distance of Point from a Line</p> $d = \frac{ ax_1 + by_1 + c }{\sqrt{a^2 + b^2}}$	<p>⑱</p>  <p>Distance Between Parallel Lines</p> $d = \frac{ c_1 - c_2 }{\sqrt{a^2 + b^2}}$	<p>⑲</p>  <p>Points are Collinear</p> <p>Area of <math>\Delta ABC = 0</math> or</p> $\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_3 - y_2}{x_3 - x_2}$	<p>⑳</p>  <p>Centroid of Triangle</p> $G\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$



**Tips:** Keep your formulas in ratio or percentage form.  
Practice with small numbers to build speed and accuracy!



# ≡ 20 Lines and Angles Rules ≡

<p>① Acute angle</p>  <p><math>&lt; 90^\circ</math></p>	<p>② Right angle</p>  <p><math>= 90^\circ</math></p>	<p>③ Obtuse angle</p>  <p><math>90^\circ &lt; \theta &lt; 180^\circ</math></p>	<p>④ Straight angle</p>  <p><math>= 180^\circ</math></p>
<p>⑤ Reflex angle</p>  <p><math>180^\circ &lt; \theta &lt; 360^\circ</math></p>	<p>⑥ Complete angle</p>  <p><math>= 360^\circ</math></p>	<p>⑦ Complementary angles</p>  <p><math>a + b = 90^\circ</math></p>	<p>⑧ Supplementary angles</p>  <p><math>a + b = 180^\circ</math></p>
<p>⑨ Linear pair</p>  <p><math>a + b = 180^\circ</math></p>	<p>⑩ Angles around a point</p>  <p>Sum = <math>360^\circ</math></p>	<p>⑪ Vertically opposite angles are equal</p>  <p><math>a = a, b = b</math></p>	<p>⑫ Adjacent angles</p>  <p>Share a vertex and a common arm</p>
<p>⑬ Parallel lines - corresponding angles are equal</p>  <p><math>a = a</math></p>	<p>⑭ Parallel lines - alternate interior angles are equal</p>  <p><math>a = a</math></p>	<p>⑮ Parallel lines - co-interior angles sum to <math>180^\circ</math></p>  <p><math>a + b = 180^\circ</math></p>	<p>⑯ Parallel lines - alternate exterior angles are equal</p>  <p><math>a = a</math></p>
<p>⑰ If corresponding angles are equal then lines are parallel</p>  <p><math>a = a \Rightarrow \text{lines } \parallel</math></p>	<p>⑱ If alternate interior angles are equal then lines are parallel</p>  <p><math>a = a \Rightarrow \text{lines } \parallel</math></p>	<p>⑲ Perpendicular lines form four right angles</p>  <p>All angles = <math>90^\circ</math></p>	<p>⑳ Angle bisector divides an angle into two equal parts</p>  <p><math>a = a</math></p>



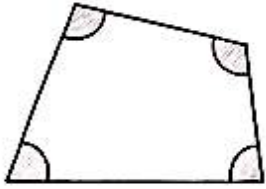
**Tips:** Learn the basic angle facts first, then use parallel line shortcuts to solve problems quickly. Always look for transversals!



# 20 Quadrilateral Rules

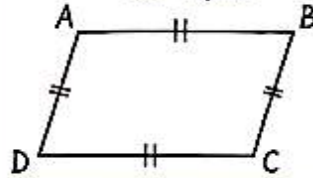
Properties, Angles, Diagonals & Areas

① Interior angle sum of a quadrilateral



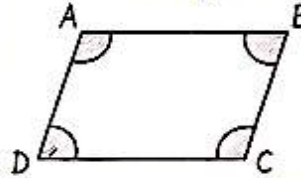
$$\alpha + \beta + \gamma + \delta = 360^\circ$$

② Parallelogram: opposite sides are equal



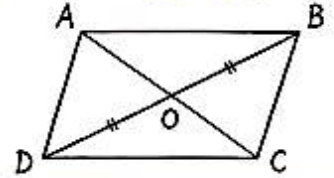
$$AB = CD, AD = BC$$

③ Parallelogram: opposite angles are equal



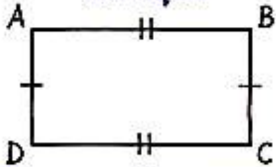
$$\angle A = \angle C, \angle B = \angle D$$

④ Parallelogram: diagonals bisect each other



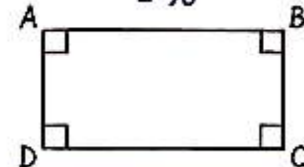
$$AO = OC, BO = OD$$

⑤ Rectangle: opposite sides are equal



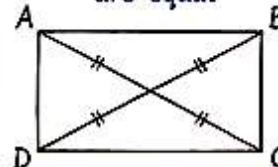
$$AB = CD, AD = BC$$

⑥ Rectangle: each angle = 90°



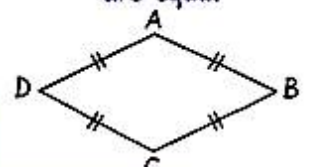
$$\angle A = \angle B = \angle C = \angle D = 90^\circ$$

⑦ Rectangle: diagonals are equal



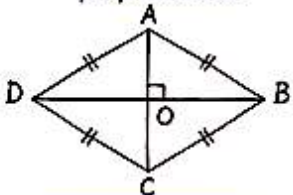
$$AC = BD$$

⑧ Rhombus: all sides are equal



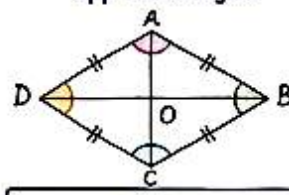
$$AB = BC = CD = DA$$

⑨ Rhombus: diagonals are perpendicular



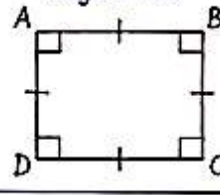
$$AC \perp BD$$

⑩ Rhombus: diagonals bisect opposite angles



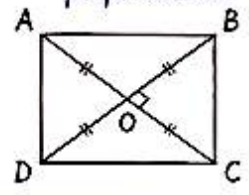
$$\text{Diagonals bisect } \angle A, \angle B, \angle C, \angle D$$

⑪ Square: all sides equal and each angle = 90°



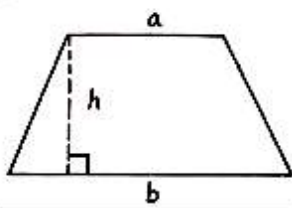
$$AB = BC = CD = DA, \angle A = \angle B = \angle C = \angle D = 90^\circ$$

⑫ Square: diagonals are equal and perpendicular



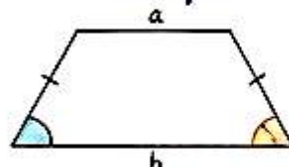
$$AC = BD, AC \perp BD$$

⑬ Trapezium area



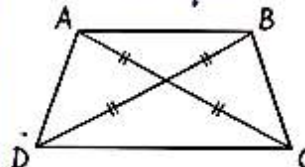
$$\text{Area} = \frac{1}{2} (a + b) h$$

⑭ Isosceles trapezium: base angles are equal



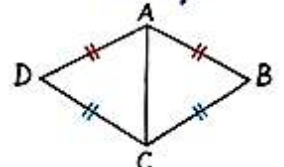
$$\angle A = \angle B, \angle C = \angle D$$

⑮ Isosceles trapezium: diagonals are equal



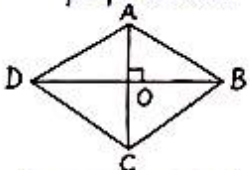
$$AC = BD$$

⑯ Kite: two pairs of adjacent sides are equal



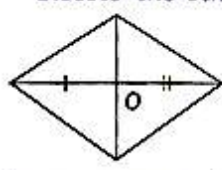
$$AB = AD, BC = CD$$

⑰ Kite: diagonals are perpendicular



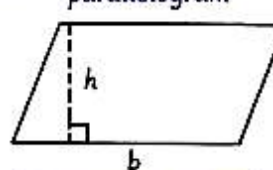
$$AC \perp BD$$

⑱ Kite: one diagonal bisects the other



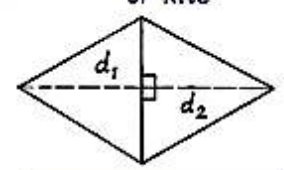
$$AO = OC$$

⑲ Area of a parallelogram



$$\text{Area} = b \times h$$

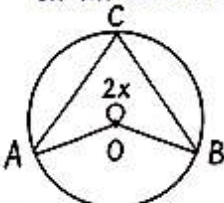
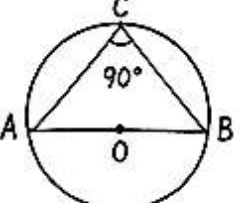
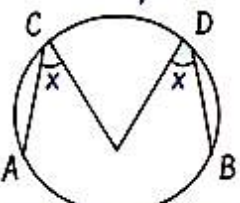
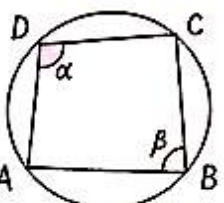
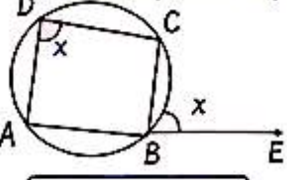
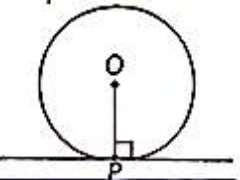
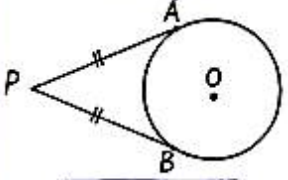
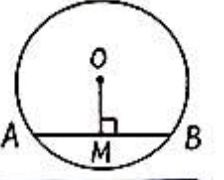
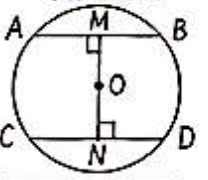
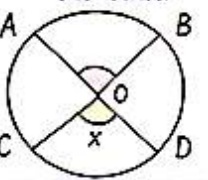
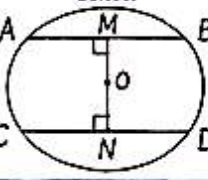
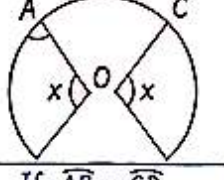
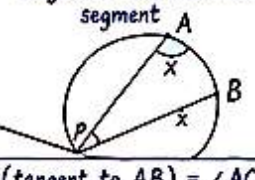
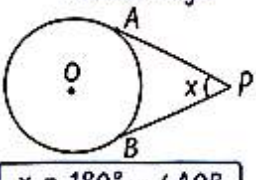
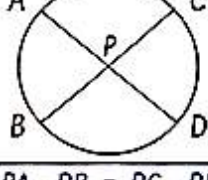
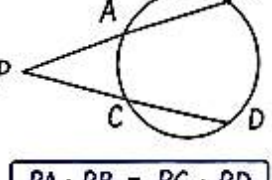
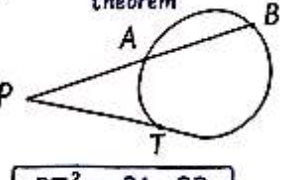
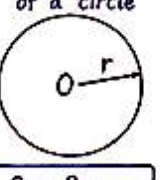
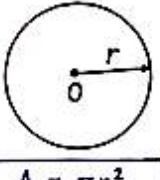
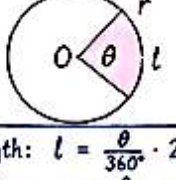
⑳ Area of a rhombus or kite



$$\text{Area} = \frac{1}{2} d_1 d_2$$

# 20 Circle Geometry Theorems

## Core Angle, Chord, Tangent & Arc Rules

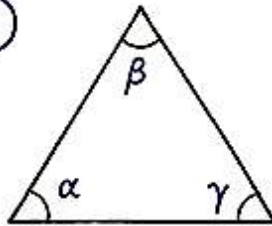
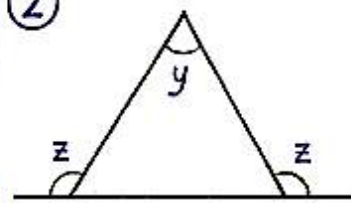
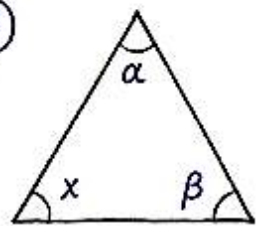
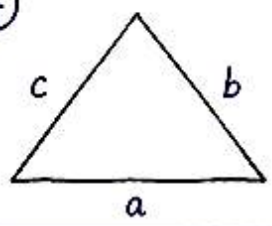
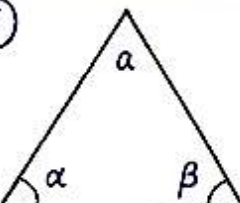
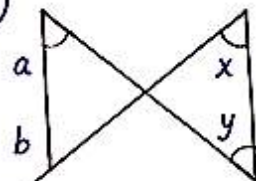
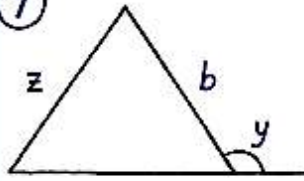
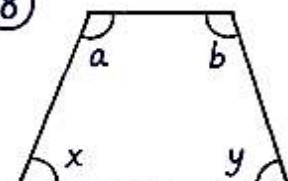
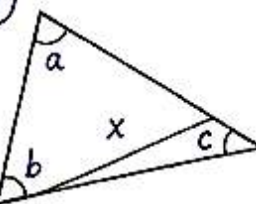
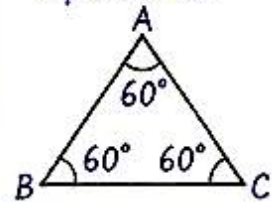
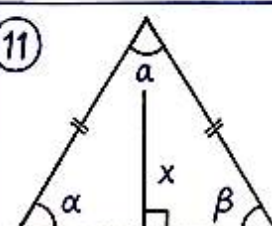
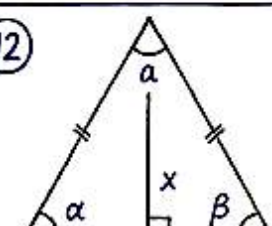
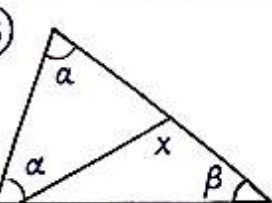
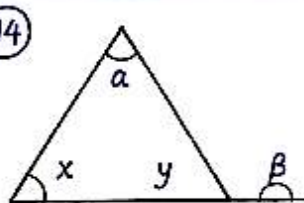
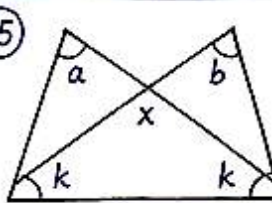
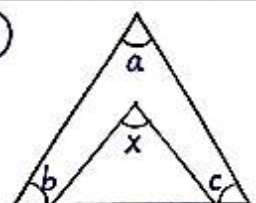
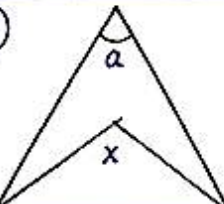
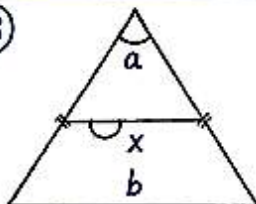
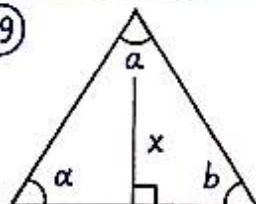
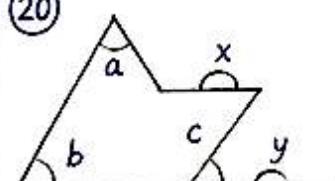
<p>① Angle at center = 2 x angle at circumference on the same arc</p>  <p><math>\angle AOB = 2\angle ACB</math></p>	<p>② Angle in a semicircle = 90°</p>  <p><math>\angle ACB = 90^\circ</math></p>	<p>③ Angles in the same segment are equal</p>  <p><math>\angle ACB = \angle ADB</math></p>	<p>④ Opposite angles of a cyclic quadrilateral sum to 180°</p>  <p><math>\alpha + \beta = 180^\circ</math></p>
<p>⑤ Exterior angle of a cyclic quadrilateral equals the interior opposite angle</p>  <p><math>\angle EBC = \angle ADC</math></p>	<p>⑥ Radius is perpendicular to the tangent at the point of contact</p>  <p><math>OP \perp \text{tangent at } P</math></p>	<p>⑦ Tangents from an external point are equal</p>  <p><math>PA = PB</math></p>	<p>⑧ Perpendicular from center to chord bisects the chord</p>  <p><math>AM = MB</math></p>
<p>⑨ Equal chords are equidistant from the center</p>  <p><math>AM = CN</math></p>	<p>⑩ Equal chords subtend equal angles at the center</p>  <p><math>\angle AOB = \angle COD</math></p>	<p>⑪ Longer chord lies nearer the center</p>  <p>If <math>AB &gt; CD</math>, then <math>OM &lt; ON</math></p>	<p>⑫ Equal arcs subtend equal angles</p>  <p>If <math>\widehat{AB} = \widehat{CD}</math>, then <math>\angle AOB = \angle COD</math></p>
<p>⑬ Angle between tangent and chord equals the angle in the alternate segment</p>  <p><math>\angle(\text{tangent to } AB) = \angle ACB</math></p>	<p>⑭ Angle between two tangents = 180° - central angle</p>  <p><math>x = 180^\circ - \angle AOB</math></p>	<p>⑮ Intersecting chords theorem</p>  <p><math>PA \cdot PB = PC \cdot PD</math></p>	<p>⑯ Secant-secant theorem</p>  <p><math>PA \cdot PB = PC \cdot PD</math></p>
<p>⑰ Tangent-secant theorem</p>  <p><math>PT^2 = PA \cdot PB</math></p>	<p>⑱ Circumference of a circle</p>  <p><math>C = 2\pi r</math></p>	<p>⑲ Area of a circle</p>  <p><math>A = \pi r^2</math></p>	<p>⑳ Sector formulas</p>  <p>Arc length: <math>l = \frac{\theta}{360^\circ} \cdot 2\pi r</math> Sector area: <math>A = \frac{\theta}{360^\circ} \cdot \pi r^2</math></p>



Tips: Look for equal angles in the same segment, equal chords and arcs, and use tangent rules — they unlock most circle problems!



# 20 Triangle Geometry Shortcuts

<p>① </p> <p><math>\alpha + \beta + \gamma = 180^\circ</math></p>	<p>② </p> <p><math>x + y + z = 360^\circ</math></p>	<p>③ </p> <p><math>x = \alpha + \beta</math></p>	<p>④ </p> <p><math>b - c &lt; a &lt; b + c</math></p>
<p>⑤ </p> <p><math>a &gt; b \Leftrightarrow \alpha &gt; \beta</math></p>	<p>⑥ </p> <p><math>a + b = x + y</math></p>	<p>⑦ </p> <p><math>a + b = z + y</math></p>	<p>⑧ </p> <p><math>a + b = x + y</math></p>
<p>⑨ </p> <p><math>x = a + b + c</math></p>	<p>⑩ If <math>AB = BC</math>, then <math>\triangle ABC</math> is equilateral.</p> 	<p>⑪ </p> <p><math>x = 90^\circ + \frac{a}{2}</math></p>	<p>⑫ </p> <p><math>x = 90^\circ - \frac{a}{2}</math></p>
<p>⑬ </p> <p><math>x = \frac{a}{2}</math></p>	<p>⑭ </p> <p><math>x + y = 180^\circ + a</math></p>	<p>⑮ </p> <p><math>x = \frac{a + b}{2}</math></p>	<p>⑯ </p> <p><math>x = \frac{a + b}{2}</math></p>
<p>⑰ </p> <p><math>x + a = 180^\circ</math></p>	<p>⑱ </p> <p><math>x = \frac{a - b}{2}</math></p>	<p>⑲ </p> <p><math>x = 45^\circ - \frac{a}{2}</math></p>	<p>⑳ </p> <p><math>a + b + c + d = x + y</math></p>



**Tips:** Mark equal angles, use straight-line ( $180^\circ$ ) and around-a-point ( $360^\circ$ ) rules, and look for symmetry & isosceles properties.

